การทดสอบซอฟต์แวร์โดยหกขั้นตอนของรูปแบบการทดสอบการยอมรับ: กรณีศึกษาโปรแกรมประยุกต์สำหรับอุปกรณ์เคลื่อนที่บนการรักษาความปลอดภัยแบบไฟร์วอลล์สองชั้น

SOFTWARE TESTING BY SIX STAGES OF ACCEPTANCE TESTING MODEL: A CASE STUDY OF MOBILE APPLICATION ON DOUBLE FIREWALLS SECURITY

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บทคัดย่อ

ในขณะที่ทีมพัฒนาซอฟต์แวร์ได้ทำการติดตั้งซอฟต์แวร์ประยุกต์บนอุปกรณ์เคลื่อนที่เหนือการรักษาความปลอดภัยที่เข้มงวดนั้น ได้ก่อให้เกิดข้อขัดแย้งระหว่างผู้มีส่วนได้ส่วนเสียเกี่ยวกับกฎระเบียบด้านความปลอดภัย หนทางในการข้ามผ่านปัญหาดังกล่าว คือ 6 ขั้นตอน ในการทดสอบการยอมรับซึ่งเป็นส่วนหนึ่งของเทคนิคด้านวิศวกรรมซอฟต์แวร์ ตัวแบบที่ถูกหยิบยกขึ้นมานี้สามารถนำมาใช้ในการประเมินระดับการยอมรับด้านความปลอดภัยซึ่งสามารถใช้ในการยืนยันการยอมรับของผู้มีส่วนได้ส่วนเสียเกี่ยวกับกระบวนการรักษาความปลอดภัย ก่อนการส่งมอบโครงการด้านซอฟต์แวร์ให้แก่องค์กร รายงานวิจัยฉบับนี้ได้นำเอากรณีศึกษาจากมหาวิทยาลัยนอร์ท-เชียงใหม่ ซึ่งติดตั้งโปรแกรมประยุกต์บนอุปกรณ์เคลื่อนที่สำหรับประกาศผลการเรียนให้กับนักศึกษาบนการรักษาความปลอดภัยของสถาปัตยกรรมไฟร์วอล 2 ชั้น 6 ขั้นตอนในการทดสอบการยอมรับถูกนำมาประยุกต์ใช้เพื่อประเมินระดับการยอมรับในการรักษาความปลอดภัย และเป็นเครื่องมือในการคลี่คลายข้อขัดแย้งของอาจารย์ เจ้าหน้าที่ นักศึกษา และนักเทคนิคด้านเครือข่าย เกี่ยวกับประสิทธิภาพของซอฟต์แวร์ในแง่มุมของการรักษาความปลอดภัยหลังจากถูกติดตั้งแล้ว ผลลัพธ์จากการวิจัยสามารถนำไปใช้เป็นแนวทางสำหรับงานวิจัยอื่นๆ เพื่อแสวงหาหนทางในการประเมินระดับการยอมรับสำหรับการใช้งานซอฟต์แวร์ในระหว่างกระบวนการทดสอบระบบ

คำสำคัญ: 6 ขั้นตอนในการทดสอบการยอมรับ การทดสอบซอฟต์แวร์ การประเมินความปลอดภัยของซอฟต์แวร์

Abstract

Once developer team implemented a mobile application over security protection, there is a confliction between stakeholders about security regulation. In order to overcome this problem is six stages of acceptance testing which is one part of software testing technique. This model could be useable to evaluate a security acceptance level which will be employed for confirm an acceptance among of stakeholder who concern about security process before deliver a software project to organization. This research pick up a case study of North-Chiang Mai University where implement a mobile application: school-record announcement system over firewall double layer architecture. Six stage of acceptance testing model is applied for evaluate a security acceptance level in order to relief a confliction from stakeholder including lecturer, staff, student and network technician about security efficiency once software was implemented. This analysis guide other research which find a model to confirming a user acceptance during software testing process.

Keywords: Six Stages of Acceptance Testing Model, Software Testing, Software Security Evaluation.

Introduction

There is a confliction among of stakeholder [1] who concern about security regulation especially organization where installed high technological and policy protection when software developer team intend to implement a mobile application [2]. By the reason that mobile platform need to operate over a formally security processing [3]. User could access to database through firewall protection [4], and bring a data set to display on mobile device. This phenomenon bring a hardship to developer team who implement a mobile application on complaint of stakeholder. There is another research which overcome similar problem as level of acceptance and factors influencing students' intention to use UCSI University's e-mail system [5]. They survey and analyzed a level of acceptance before implement new version of e-mail system which is protected by higher security.

This research reviewed various kind of possibility models that could be used for overcoming that problem, and discovered the six stages of acceptance testing model [6]. This model is used during software testing process that developer evaluate an acceptance from user before they deliver a software project. Thus, this model could be used for assessing concerning to security acceptance level when organization implement a mobile application on high protection system.

In order to approve an idea, this research bring a case study form North-Chiang Mai University where software developer team faced with confliction problem similar to research idea. North-Chiang Mai developer team developed mobile application for support a school-record announcement system [7]. However, application will operated over firewall double layers architecture. One thing that created a confliction is penetrate from

student to 1st firewall from outside University into registration database which is behind 2nd firewall. Moreover, school-record dataset will be transferred into mobile device for display to student.

Even though mobile application created a high satisfaction level on student who have a convenience from software [8], there is an unclearness from network technician who have a directly authority for system protection. In order to ease up a problem, confliction is applied to be research problem statement that research objective is relieving a confliction between stakeholders during software testing process [9].

In order to respond with research objective, six states of acceptance testing model is used for evaluate an acceptance of stakeholder regarding to security system after mobile application is implemented. Analysis result will be employed for confirm that involving user could accept mobile application which operate on current security system. Moreover, it is an armor for developer team who negotiate about software implementation to network technician.

Objectives

In order to respond with research objective that to relief a confliction problem among of stakeholder concerning to security acceptance for mobile application over firewall double layer, this research compromised a research model from theoretical model combination as follows:

The six stages of acceptance testing is a model which use for evaluate an acceptance level of user who employ a software [6]. This model is one part of software validation which is used for test a user requirement on acceptance testing during software testing process. Therefore, software tester bring a model to implement during testing process in order to ensure that all stakeholder accept a software implementation as figure 1.

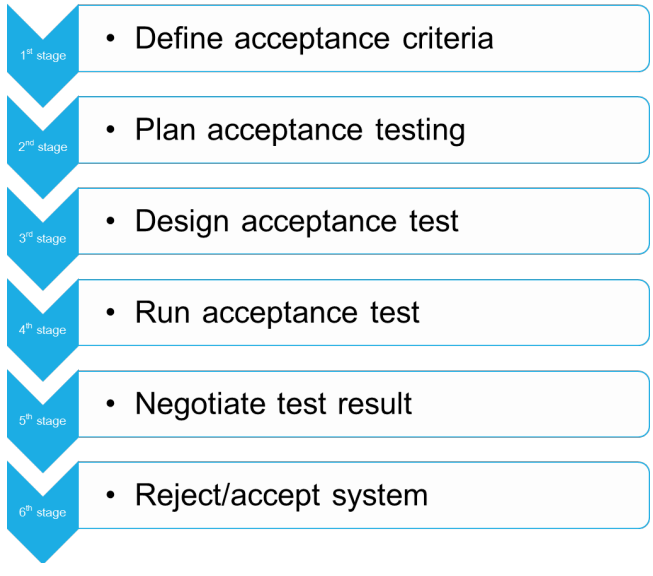

Figure 1. The Six Stages of Acceptance Testing Model [6].

From figure 1, the six stages of acceptance testing model begin from acceptance criteria definition.

1st stage, developer team consult with stakeholder and project manager concerning to criteria which everyone could accept. This step is an importance process by the reason that it is a discipline which impact to reject or accept result.

2nd stage is an acceptance test design that developer team connect with project manager and all stakeholder regarding to schedule, budget, involving target, cultural organization and change management.

3rd stage is an acceptance test design. This stage gather an information from 1st stage, and arrange them to test form in various format including investigation and interview form. These form will be implement in each agendas which were planed from 2nd stage.

4th stage is an acceptance testing process. Various kind of form from 3rd stage will be implemented in 4th stage. Moreover, data collected is analyzed follow an acceptance criteria from 1st stage in order to conclude an acceptance result into stakeholder.

5th stage is a result negotiation that project manager bring an acceptance result to negotiate a project delivery which should be accepted from stakeholder.

Last stage is an acceptance result. This stage is an end of six stage of acceptance testing model. Developer team could bring an accepted result to confirm with disagreement person regarding to acceptance from every side. On the other hand, in case of rejection, developer team could come back to revise a system design or consider about acceptance criteria later.

Beside, this research intend to experiment with a case study: mobile application on double firewalls security. Hence, this environment should be explained as follows:

Firewall double layers architecture was constructed for dividing various kind of server by depend on priority of protection [10]. Ordinary, web server is provided before 2nd firewall and behind 1st firewall which are difference technology in order to stall for time an attacker who could access to 1st firewall even though they have not an authority. In part of importance server such as financial or school-record server will be prepared behind 2nd firewall for provide highest protection as figure 2.

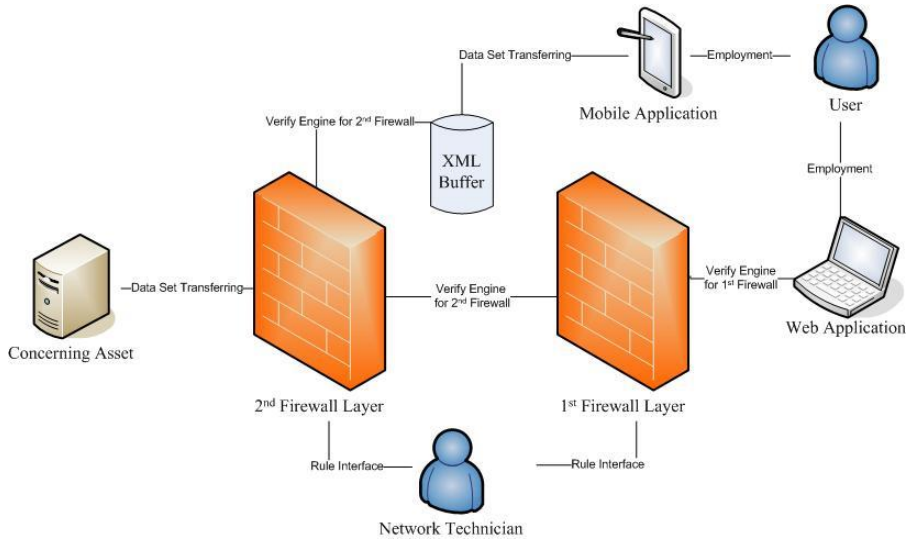

Figure 2. Mobile Application on Double Firewall Layers.

From figure 2, user access on domain which operated behind 1st firewall before verify themselves to 2nd firewall. However, mobile application transfers a data set in XML format from financial or school-record server to display those data on mobile device by not depend on firewall security processing. Data set is requested from external side and access directly to XML buffer which accessed and kept an importance data set [11]. Notice, there is not 1st firewall verification that contrast with other security regulation.

From literature review, this research compromised the six stages of acceptance testing model with mobile implementation on double firewall security in order to construct an experimental model as figure 3.

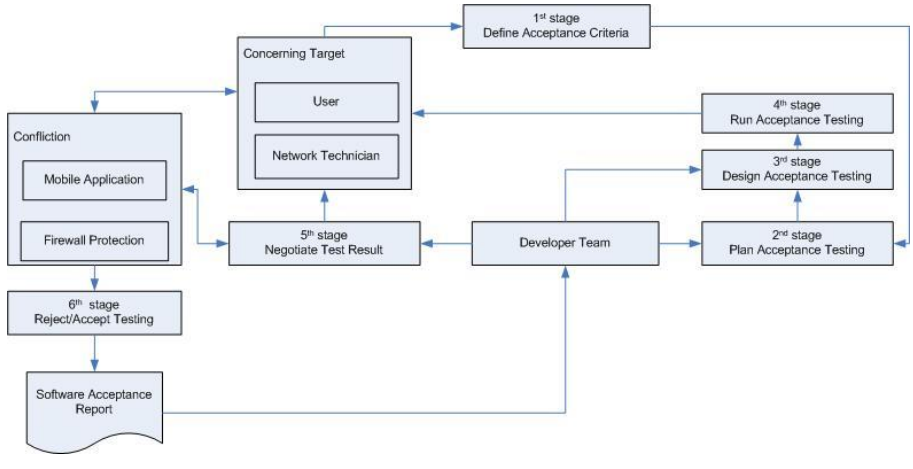

Figure 3. Experimental Model of Software Testing by Six Stages Acceptance Testing.

From figure 3, this model was designed by begin at define an acceptance criteria process which collected data from concerning target including user and network technician in order to analysis an acceptable criteria for confirm a final result that everyone are satisfied. Secondly, developer team developed an accepted testing plan in order to organize an approving entire software testing process. Thirdly, developer team bring a test plan to design an acceptance testing in various format including interviewing and investigation forms. Fourthly, acceptance testing forms will be implemented on concerning target in order to collect and analysis a system acceptance level. Fifthly, acceptance result will be employed for negotiate with concerning target in order to confirm about system acceptance in point of mobile application which operated on firewall protection. Sixthly, there is a result form six stages acceptance testing about final result that will be transfer to software acceptance report. This report is transferred to developer team in order to ensure regarding to level of acceptance from concerning target later.

From model construction, this research aware to reliability of model. So, research statement is eased up to hypothesis as follows:

H_0: there is not a difference of confliction number after concerning target use a six stages of acceptance testing model.

H_1: there is a difference of confliction number after concerning target use a six stages of acceptance testing model.

Therefore, those hypotheses will be approved by research methodology as section 3.

Methods

This research approve an efficiency of model by design an experiment for case study of North-Chiang Mai University in Thailand, where encounter with problem similarly to problem research statement of this model, to be control variable.

Data collection request a presenter who will respond with software verification and representative interview from 5 faculties and 5 institutes of North-Chiang Mai University. Those Target respondents are divided a proportion follow a population of each faculty and institution. Each unit kind prepare a target respondents who respond with research. There is an exactly number of target respondent from all unity including 50 lecturers, 10 staffs, 10 network technicians and 230 students who have a confliction about school-record announcement in format of mobile application that operated over firewall double layers architecture Therefore, target respondent is represent of North-Chiang Mai University population.

This research divided an experiment to 2 parts including backward measurement and forward measurement.

Backward Measurement

This section is prepared for approving an efficiency of six stages of acceptance testing model which operated under mobile application project that installed over firewall double layers. Therefore, measurement is a consistency evaluation between acceptance criteria with negotiate test result and accept/ reject testing. Research collect and analyzed data by interviewing a represent target

including head of network technician, head of staff, lecturer presenter from faculty and student presenter in each faculty. Experiment result will be employed for confirm an efficiency of six stages of acceptance testing which used for control and reconcile a confliction among of stakeholder.

Forward Measurement

Developer team bring a problem statement, and apply it to investigation form which was implemented on concerning target in order to approving an efficiency of testing model. Then, there is a data collection before and after model implementation about number of confliction. Those data will be analyzed from 300 target respondents, and relies on comparative method [4, 12] in order to approve a hypothesis testing regarding to confliction number between before and after model using.

The analysis result approve a hypothesis testing that confirm an efficiency of model for relieving a problem statement which is confliction among of concerning target.

Results

From experiment follow research methodology design, this research constructed a project regulation which operated follow algorithm from research model. And, there is an experiment result as follows:

Backward Measurement

Research operated a software project testing follow regulation of six stages acceptance testing model. In order to approve that model could be used for software testing and relief a problem statement, developer team collect a data during software testing process by interviewing form for target respondent, and researcher analyzed a result as table 1.

Table 1. Efficiency Analysis 1st Edition for Six Stages Acceptance Testing Model.

Items	Testing Process	Interviewing Data	Analysis Result
1	Acceptance criteria	Network technician keep a security standard which depend on satisfaction level of user, and NIST standard 800-30	Pass
		Staff keep a security policy which allow a student access to system during student-record announcement time.	Pass
		Lecturer keep a security policy which allow them access to system during student-record announcement time.	Pass
		Student keep a security policy which allow them access to system during student-record announcement time.	Pass
2	Negotiate test result	Network technician not allow a data transferring to XML buffer over firewall double layers.	Fail
3	Accept/reject testing	Network technician inform rejected result.	Fail

From table 1, network technician confirm a rejected result to developer team. Hence, mobile application for student-record announcement could be not to install for service to stakeholder. Developer team bring six stages of acceptance testing model to relief a problem in 2nd edition.

Table 2. Efficiency Analysis 2nd Edition for Six Stages Acceptance Testing Model.

Items	Testing Process	Interviewing Data	Analysis Result
1	Acceptance criteria	Network technician keep a security standard which depend on satisfaction level of user, and NIST standard 800-30 which is a risk management.	Pass
		Staff keep a security policy which allow a student access to system during student-record announcement time	Pass
		Lecturer keep a security policy which allow them access to system during student-record announcement time.	Pass
		Student keep a security policy which allow them access to system during student-record announcement time.	Pass
2	Negotiate test result	Developer team bring commitment from acceptance criteria for negotiate with network technician, and focuses that there is not a low level of satisfaction for IT operation. Moreover, security solution is not prepared according with level of risk that there is a medium level of risk, but they use high level of security solution.	Pass
		Network technician allow a stakeholder access to system during student-record announcement time.	Pass
3	Accept/reject testing	Network technician inform accepted result.	Pass

From table 2, developer team win for negotiation by confirm a network technician with acceptance criteria. Then, they could install a mobile application for service a stakeholder. This result show that six stages acceptance testing model suitable with software testing process that there is confliction between stakeholder.

Forward Measurement

After approve an efficiency of six stages acceptance testing model, forward measurement will approve an efficiency of relieving a confliction problem for software testing by six stages acceptance testing model employment.

Therefore, this research gather a confliction number before and after 3 months that employ a regulation testing from target respondent. The testing analysis was developed from problem statement that there are confliction between stakeholder concerning to mobile application operating on firewall security. Thus, there are analysis result as table 3:

Table 3. Efficiency Analysis of Six Stages Acceptance Testing Model Employment for Confliction Reliving.

Items	Confliction Issues	Before use a model 3 months (Frequency)	After use a model 3 months (Frequency)
1	Network technician not allow a network policy for student who would like to access into school-record announcement data by mobile application.	146	0
2	Staff is rejected from network technician who not allow a staff to active an XML buffer for announce school-record for student.	8	1
3	Lecturer could not access to school-record announcement system on mobile application.	21	2
4	Student complain a staff that deny a service regarding to school-record announcement on mobile application	134	0
5	Staff and lecturer complain a network technician regarding to service rejected.	11	0
6	Network technician request to chief information officer regarding to misunderstanding of all stakeholder about security.	7	3

From table 3, there are 6 items of confliction between target respondent who is concerning stakeholder. First item, after developer team implement a regulation testing, a frequency of problem reduce from 146 to 0. It means that network technician accepted a necessary of mobile application using which operated over firewall policy. Second item, confliction number reduce from 8 to 1. It means that network technician accepted a staff operation which need to be allowed for active a school-record announcement system.

Third item, confliction number reduce from 21 to 2. It means that lecture accepted a regulation concerning to school-record announcement on mobile application that service time follow by staff and network technician coordinate each other, and depend on academic calendar. Fourthly, confliction number reduce from 134 to 0. It means that student accepted a regulation which control network technician and staff operation concerning to school-record announcement on web application. Fifth item, confliction number reduce from 11 to 0. It means that staff and lecturer accepted and be satisfied network technician operation after network technician accepted a system regulation. Last item, confliction number reduce from 7 to 3. It means that network technician accepted a regulation and without prejudice of other stakeholder concerning to security policy. Even though perfect acceptance level should be defined that there is not a confliction, they accepted an error which occurred from routine operation and subjective of each person.

From comparing all items, this research accepted H_1, and rejected H_0 that there is a difference of confliction number after concerning target use a six stages of acceptance testing model. Therefore, this research could confirm that six stages of acceptance model could be used for relief a confliction among of stakeholder in order to test a software which is accepted from all side. Eventually, this research achieve a research objective which intend to reduce a confliction that is main problem statement of research. It reflect that research could create a contribution to software industry who found a problem according with this idea.

Conclusions and Discussion

This research discovered a confliction problem during software testing. In this case confliction involving a mobile application which operated on firewall double layer. Hence, literature review pick up a six stages of acceptance testing which is a software validation model in order to relief a problem statement that is one part of software requirement. Thus, this research evaluate an efficiency of six stages of acceptance testing model by implemented in mobile application: school-record announcement system project, and discover that it could be used for negotiate with stakeholder until they accepted a system operation.

On the other hand, this research founded once developer team implement a six stages of acceptance testing model in testing regulation format, there is a difference of confliction number after concerning target use a regulation testing by the reason that they are committed from criteria testing which developed from themselves. Therefore, this model could be used for implement in other software project testing which confront with similar to research problem.

Project manager could bring a model to relief various confliction in customer organization in order to deliver a software project without suspicion from customer. Development and change management plan should be prepared for reducing a possible confliction in order to supporting a digital transformation in each organization. Besides, there are unit and system level which should be evaluate by software verification. Developer team could bring a software verification and validation technique for approve an efficiency of software project in dimension of system performance and acceptance from stakeholder. This idea could be used for decency to other analysis design later.

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